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ABSTRACT

The idea of semantic features has taken some force within psychology and a number of research workers have suggested that semantic acquisition is, in some manner, determined by semantic components. This notion has come to be called the "semantic feature hypothesis". An examination of the semantic feature hypothesis was made by testing 80 New Zealand children (40 Maori and 40 European), four years of age, for comprehension of the semantic components, as specified by Manfred Bierwisch, of a set of spatial adjectives. Results indicated that a componential analysis does not offer a valid model for the acquisition of either words or of word meaning. The problem would seem to be that it is impossible to derive a theory of semantic processing or of semantic acquisition solely from one level of analysis. The acquisition of the words of the spatial set (big - little, high - low, etc.) can best be dealt with by a multi-level model of processing which postulates as its elements verbal forms (signifiers), perceptual preferences, and cognitive operations. (Author)

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FIRST NEW ZEALAND LINGUISTICS CONFERENCE 25-28 August, 1976

# AN EXAMINATION OF THE VALIDITY OF A COMPONENTIAL ANALYSIS AS A GUIDE TO SEMANTIC ACQUISITION

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# AN EXAMINATION OF THE VALIDITY OF A COMPONENTIAL ANALYSIS AS A GUIDE TO SEMANTIC ACQUISITION

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The linguist Bierwisch has suggested that there are innate and universal semantic primes that are organised differently in different languages. He offers few guidelines as to what these features might be, beyond stating that,

> The semantic features do not represent ..... external physical properties, but rather the psychological conditions according to which human beings process their physical and social environment. Thus they are not symbols for physical properties and relations outside the human organism, but rather for the internal mechanisms by means of which such phenomena are perceived and conceptualised.
>
> (Bierwisch, 1970)

In various sets, according to Bierwisch, these features form semantic fields. Natural language concepts can be represented, he believes, as the combination of meaning components or sense characteristics for each particular word, and the rules for the co-occurrence of words in sentences are determined by the matching of their respective meaning components.

Bierwisch's work belongs in that class of explanation for the structure of meaning known as interpretive semantics. Following publication of the paper by Katz and Fodor (1963) on the structure of semantics, this form of semantic representation has come to be accepted as an appropriate one for a transformational generative grammar of the kind developed by Chomsky.

## The semantic feature acquisition hypothesis

Just as Chomsky's theory of syntax became a model for studies of language

acquisition and students of child language began to write transformational grammars for the language of young children (Bloom, 1970; Bowerman, 1973), the establishment of interpretive semantics sparked off a search for the manner in which meaning (defined as semantic components) is acquired.

Particular impetus for the use of componential analysis as a model for the acquisition process came from Jakobson's hypothesis that phonological features are both universal and acquired according to the principle of maximal contrast. The transfer of this model to semantic acquisition is suggested in the following quotation from McNeill,

> The addition of a semantic feature to a dictionary is an event with ramifying consequence ... Each new semantic feature is a distinction that separates one class of words from another. (McNeill, 1970, 116).

The basic idea is that language development proceeds from an undifferentiated original condition to a greater differentiation and separation. What a componential analysis does is to specify the basis for a distinction in meaning between one linguistic term and another. These specifications or features, therefore, mark some words off from others and can be said to provide a shared basis of relationship (similarity in one or more features) for certain sets of words.

A number of psychologists and psycholinguists have suggested that semantic acquisition is, in some manner, determined by semantic components of meaning. The principal advocates of the idea have been Eve Clark and H.H. Clark. The notion has come to be called the "semantic feature acquisition hypothesis".

It should be pointed out that very few componential analyses have ever been carried out either by linguists or by anthropologists and what has been done has been restricted to small and highly structured sets of words. Claims for a semantic feature explanation for the acquisition of

either words or meaning rest on even more slender evidence than exists for the presence of semantic fields since practically the only semantic feature that has received much research attention is polarity (or antonymy) and no complete psychological exploration of any one defined field appears to have ever been made. Much of the so-called evidence for a semantic feature explanation for meaning acquisition has been amassed by using the idea of features as an explanation for data collected for reasons other than to test the theory of feature acquisition, or from studies of single pairs of words.

What is the psychological evidence for semantic features? Over-extensions of word use by young children, differences in the order of acquisition of words of different value, and the kind of patterns revealed when children and adults are asked to give free associations to words have all been put forward as evidence for the psychological reality of semantic features. I shall give just three examples of "semantic feature" explanations. Eve Clark (1973a) has suggested that the young child's over-extensions of meaning are due to a shortage of "features". At first, for example, children tend to label a variety of animals *dog* and only learn later to distinguish dogs from other four-legged animals. To quote from Eve Clark (1974, 108),

> ... the child begins by identifying the meaning of a word with only one or two of its semantic components on features of meaning, rather than with the complete combination of components used by the adult.

According to Eve Clark, this leads younger children to use broader categories of meaning than do older children or adults. However, it should be pointed out that there is evidence from diary studies to show that children both over-extend and over-discriminate in the process of the acquisition of referential meaning. *Hot*, for example, may be restricted

to a single object such as a stove. *Truck* may refer only to a special toy truck. It is difficult to explain the process of over-discrimination on the basis of feature acquisition. Do children start off with too many features and then lose some of them?

The second example is concerned with the fact that young children frequently confuse terms of like pole; *big* with *high*, for example, or *heavy* with *strong*. Brewer and Stone (1975) suggested that a "modified semantic feature hypothesis" best fits these facts. By this they mean that a positive polar feature develops before other features and that the positive poles are, as a consequence, acquired before the negative ones.

In what he calls the "principle of lexical marking" H.H. Clark (1969) has given a different theoretical explanation for the fact that children acquire the positive term of polar pairs before they learn the negative term. According to his view, children learn first the basic or unmarked meaning of antonym pairs. The negative term is acquired later because the child has to acquire an extra marker.

While the principle of lexical marking provides an explanation for meaning acquisition based on the complexity of individual words the modified semantic feature hypothesis suggests that a polar heuristic (i.e. a feature) determines acquisition of words.

Some general points of criticism can be made at this point. One of the weaknesses of the semantic feature acquisition hypothesis is that a "feature" never seems to be adequately defined. The features suggested by various writers include factors which are perceptual such as "top point", (Maratsos, 1974), cognitive (for example, proportion), simple descriptive (four-legged), and linguistic (antonymy). One can agree with Nelson's (1974) criticism of Eve Clark's (1973a) list of features that the notion of feature is in desperate need of clarification.

A further problem is that there seems to be considerable confusion as to what the positive and negative signs which are applied to word markers actually mean. When words differ in polarity, for example, they are in contrastive opposition and a middle term is implied. *Long* and *short*, for instance, imply a norm in between the extremes. However, if one takes a feature such as (+Vert) then this implies not-*wide*. The opposition here would seem to be binary rather than contrastive.

In summary it can be said that the semantic feature acquisition hypothesis in its various guises has been applied to two different sets of data:

(i) the order in which words are acquired

(ii) the order in which features are acquired.

Before I go on to discuss the validity of explanations such as the ones just given I shall present the outline of an analysis by Bierwisch (1967) of a set of German adjectives applying to objects in space. In English these words can be translated as *big-little, long-short, high-low, wide-narrow, deep-shallow, far-near, thick-thin, fat-thin* and *tall-short*.

The Bierwisch analysis

Bierwisch provides a set of 5 features from which are derived 8 markers. The features are Polarity, Space, a feature which produces the marker (Main). Proportion which produces two markers (Max) and (Second), and Orientation which produces three markers (Verticality), (Inherent) and (Observer). These are distributed over the adjectives of the set. All words are marked with the feature of polarity either with a negative polar marker (e.g. *short*) or with a positive polar marker (e.g. *long*). All words are also marked with an abstract marker which Bierwisch calls (Space) and which is supposed to represent the number of dimensions each adjective is able to refer to. For example *big* can refer to 1, 2 or 3 dimensions and is, therefore, marked

(*n* Space) while *high* is marked (1 Space) because it can be used to refer to only a single dimension. The next major distinction is on a feature related to Volume from which Bierwisch derives a marker (Main). *Thick* refers to secondary dimensions and is marked (-Main) while *big* refers to main dimensions and is marked (+Main). Broadly speaking, Bierwisch considers the features discussed so far to be attached to the adjective itself. The remaining features are supposed to be attached to the words referring to the objects to be described. For example, the feature (+Inherent) refers to the property of an object and in particular that it has extension irrespective of its orientation in space. A *tall* man remains *tall* whether he is standing up or lying down. The feature of Verticality on the other hand refers to a position in space with respect to the surface of the earth. If a tall building is knocked down sideways it can no longer be described as *high*. In the Bierwisch analysis both (±Inherent) and (±Vert) are connected to a deep feature of orientation and so too is (±Observer) which refers to the distance that an object recedes from a hypothetical observer. *Deep* as applied to a drawer or cupboard is marked (+Observer). A marker (±Max) is supposed to be linked to an underlying feature of proportion and a further marker (+Second) serves to make the distinction between the two dimensions in the horizontal plane, (+Max) serving to distinguish *long* and (+Second) to distinguish *wide*.

Following are the lists of features for the words *big*, *little*, *long*, *short*, *wide* and *narrow*.

*Big* (+Pol) [(*n* Space)[(+Main)]]
*Little* (-Pol) [(*n* Space)[(+Main)]]

*Long* (+Pol) [(1 Space)[(+Inherent)[(+Max)]]]
*Short* (-Pol) [(1 Space)[(+Inherent)[(+Max)]]]

*Wide* (+Pol) [(1 Space)[(+Second)]]
*Narrow* (-Pol) [(1 Space)[(+Second)]]

These features can also be represented in dependency trees rather than by bracketing in which case the pattern is as follows:

(±Pol)

↓

(*n* Space) (1 Space) (2 Space) (3 Space)

↓

(±Main)

↓

(±Vert) (±Max) (±Observer) (±Inherent) (±Second)

These levels are processing levels and in the cluster at the bottom of the tree the markers are, with one exception, supposed to block each other. Thus (+Vert) implies (-Max), (-Observer) and (-Second). However, (+Max) combines with (+Inherent) to supply sense characteristics for *long*.

A study of four-year-olds

I have recently completed a study of the interpretations that 4-year-old Maori and Pakeha children give to the word pairs analysed by Bierwisch. During the course of this study I took the opportunity to test the validity of the semantic feature acquisition hypothesis. I used Bierwisch's componential analysis as the model for the meaning components of the words and prepared materials of various kinds that would allow me to contrast systematically one feature with all those other features that the model places in opposition to it. This pattern was then followed for three separate test series. In the first series, children were asked to recognise the target word but were not required to say it. This was called the component series and the first part of it exemplified the polar component and objects were arranged in series of three. The second part of the component series exemplified the other components such as (+Vert) and (+Inherent) and each feature was shown in a (+Pol) and a (-Pol) version.

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In the next series the same pattern was followed (although not all oppositions were tested) in story items in which the children were asked to solve problems the solution to which required knowledge of the concepts referred to by the words.

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A third series attempted to elicit the words of the set.

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Finally, there were tests for the feature of proportionality, and for normativity which is, of course, implied by polar opposition.

There were approximately 100 test items. The sample consisted of 40 Maori children and 40 Pakeha children selected by asking the mother to give the child's identity and the children were drawn from pre-school centres in a variety of settlements half of which could be called rural and half urban.

I shall now examine five interpretations of the semantic feature acquisition hypothesis in order to see whether or not they ring true.

1. Word order is determined by value difference on markers, words marked positively being acquired before words marked negatively. *Big, long, high, wide* and *thick,* for example, should be acquired before their antonyms.

In the Bierwisch model the related polar pairs differ only in the value of the polar markers. One can agree that (+Pol) words are, in general, acquired before (-Pol) ones. The point at issue is whether this is due to a polar feature. Is one justified, for example, in talking about a polar feature if the child knows only one of the words of a polar

pair? While the words related to *big* can properly be called the positive pole words, one cannot argue from this that the child uses a positive pole strategy, only that he shows a predisposition to notice big things.

*Long, high* and *deep* precede their antonyms, but it is by no means certain that *big* precedes *little*. The evidence from lists of "first words" suggests that *big* and *little* may be acquired at the same time. Moreover, at least two (-Pol) words *little* and *near* are acquired before some (+Pol) words such as *wide* and *thick*.

If one looks beyond the polar feature there are other oppositions in the Bierwisch analysis which differ in value on only one marker. *Big* and *thick*, for example, differ in value on the marker (Main). *Far* and *long* differ in value on the marker (Inherent) and *long* has an additional marker (Max). *Big* is certainly acquired before *thick*, *thick* being negatively marked but *long*, marked positively on (Inherent), does not appear to be learnt earlier than *far*. Altogether the evidence for words of positive value being acquired before those of negative value seems ambivalent.

2. Word order is determined by the number of features marking each word, words with fewer markers being acquired before those with more markers.

In the Bierwisch model only one word has more features than the others and that is *long*. *Long* has four and all the rest have three. Therefore *long* should be acquired last. In fact *long* seems to be an early acquisition. *Big* and *little* are first produced at about the age of 2 years and *long* seems to be produced in the second stage of acquisition at about 3 years or more.

3. The features are acquired in a fixed order. The order of processing given by Bierwisch and presented earlier in a dependency tree implies an order for the acquisition of features. It will be sufficient here to note only that the feature of polarity (antonymy) is set highest in the processing order and therefore must presumably be the first to be acquired.

I do not want to go into this issue in detail but will say that, in general, I do not believe it to be true. Words seem to acquire meanings from the contexts in which they are first used, rather than from underlying features. The best example of this from the words in the Bierwisch set is *deep*, which is "marked" for four-year-olds by (+Water).

4. A feature can act as a heuristic for the elucidation of unfamiliar terms. On this view, for example, the child first acquires *long* and polarity supplies a strategy for the discovery of the meaning of *short*.

Do features act as mechanisms for the acquisition of meaning? For example, do children learn the meaning of a (-Pol) term such as *shallow* by working out that it is the polar opposite of *deep?* The short answer would appear to be *no*. Polarity implies at least three objects arranged in a series, that is an object which has an excess of whatever quality is under discussion, another which has a deficit of the quality, and an unspecified number of middle objects.

My present work and that of Wales and Campbell (1970) show how persistently the child chooses (mid)-items in forced choice tasks when he does not know a (-Pol) word. And if there is more than one middle item the child will tend to choose the larger of these. This suggests

that the contrary opposition of the antonym pairs does not precede acquisition of the second word. The data from my project do not support the belief that children select extremes as opposed to non-extremes.

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Evidence against polarity as a heuristic which leads to the early acquisition of (+Pol) terms can be found in the fact that some (+Pol) words are slow to be acquired. *Wide* and *thick* fall into this category. So while the notion of polarity as a mental structure which helps a child to elucidate meaning is an attractive one it also seems to hold little water. In fact, it is almost certain that polarity is formed by words and is hence a genuine case of language determining thought. A child seems to understand polarity only when he knows the two words which apply to the ends of a polar scale, say, *tall* and *short* and hence he learns polarity piece by piece as he acquires the word pairs.

5. When words share features they tend to be confused with each other, and are likely to be most confused when they differ from each other on only one feature or value.

It is well known that young children confuse *high* and *tall* with *big* for example, and these words are marked by shared features. But then all the words of the Bierwisch set share features - that is what makes them a set - and some of the words are readily confused and some are not. *Big*, for example, is not readily confused with *thick* and yet these two terms, supposedly, differ by no more than the value of one marker and are hence in minimal contrast.

What is innate?

What appeared to be innate and common to both the Maori and the Pakeha children was a tendency to choose some objects rather than others. This

phenomenon is often referred to as response bias but it might be more profitable to think of such actions (both intellectual and physical) as strategies and to consider that it is the coincidence of these patterns of response with language meaning which leads to the building up of word meaning. Eve Clark (1973b) made a study of *in*, *on* and *under*, and showed how young children interpreted these on the basis of the properties of the objects provided (in this instance whether they were hollow or flat-surfaced), irrespective of the word presented. In a similar vein, Greenfield, Nelson and Saltzman (1972) have shown that there is a developmental order of manipulative strategies that are customarily used by young children when playing with sets of nesting cups. My own study showed how, in a variety of task settings, unconstrained choices are usually choices of the biggest item. It seems very probable that early meaning is derived from a hierarchy of preferred responses.

There is little doubt, however, that the derivation of the words of the Bierwisch set is, in the main, from *big* and *little*.

It seems unlikely that children do use incomplete but otherwise adult models of semantic competence any more than they use incomplete but otherwise adult models of syntax, but rather that their semantic systems, like their syntactic models, or their phonological systems, or their logical models go through a series of successive approximations to adult structures. One would expect, therefore, that the features used by a young child would differ to some extent from adult features both in number and in type. The task of the student of child language is to crack the child's own semantic code.

The place of words

A componential analysis converted into a semantic feature acquisition hypothesis posits a deep structure; a special layer of cognitive functioning. The specification of levels without allowance for

interaction between these levels leads to over-simplified accounts of meaning acquisition. It precludes, for example, the inclusion of words as factors in the acquisition of meaning.

Once words begin to be acquired they act as place-markers for meaning and become additional sources of information to the child about the meanings of other words. There are in fact, two separate issues in the acquisition of word meaning; how does the child acquire meaning for his very first words, and how does a child acquire meaning once his lexicon has begun to develop.

The real problem seems to be that it seems quite impossible to derive a theory of semantic processing, not to speak of semantic acquisition, solely from one level of analysis whether that analysis is syntactic, semantic or cognitive.

The conclusion to be drawn is, therefore, that the semantic feature hypothesis in any form is an inadequate hypothesis to account for the order in which words are acquired and the growth of word meaning. Certainly children do work out the way in which words used in similar contexts differ among themselves, but they make good use of the clues provided by the objective world in order to do this.

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